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## SURVEY REPORT

AIR QUALITY SURVEY (TAGA)

PPM MOBILE PCB

DESTRUCTION FACILITY

TEXACO REFINERY

MISSISSAUGA, ONTARIO

SEPTEMBER, 1987

ARB-163-87

FEBRUARY 1988

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Ministry  
of the  
Environment

E. PICHÉ, Director  
Air Resources Branch

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Survey Report

Air Quality Survey (TAGA)  
PPM Mobile PCB Destruction Facility  
Texaco Refinery  
Mississauga, Ontario  
September, 1987

ARB-163-87

-prepared for-

The Central Region  
Ontario Ministry of the Environment

-prepared by-

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Air Resources Branch

FEBRUARY 1988

c Queen's Printer for Ontario, 1988

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## Executive Summary

On September 30, and October 1, 1987, the mobile Trace Atmospheric Gas Analyser (TAGA) unit of the Air Resources Branch conducted an air monitoring survey at the Texaco Refinery in Mississauga, Ontario. The survey objective was to provide on-site, near real-time measurements of ambient air PCB concentrations during the operation of a mobile PCB destruction unit operated by PPM (Canada) Incorporated. The operation involved the decontamination of approximately 10,000 litres of transformer oil containing approximately 750 ppm of PCBs.

During the two days of monitoring, a total of 283 2-minute air samples was screened for selected PCBs using the Ministry's TAGA (3000) unit. None of the 19 1/2-hour averaged concentrations for PCBs (computed from the 2-minute samples), exceeded the Ministry's 1/2-hour Guideline of  $0.45 \text{ ug/m}^3$ . In fact, PCBs were not detected during any of the monitoring periods including the background samples. The average detection limit for the TAGA was  $0.11 \text{ ug/m}^3$  for total (di- to pentachlorobiphenyl) PCBs.

## Résumé

Le 30 septembre et le 1<sup>er</sup> octobre 1987, une analyse atmosphérique a été effectuée à la raffinerie Texaco de Mississauga à l'aide de l'unité mobile d'analyse des gaz atmosphériques à l'état de trace de la Direction des ressources atmosphériques. L'objectif de cette analyse était d'obtenir des mesures réelles sur place portant sur l'air ambiant pendant le fonctionnement d'une unité mobile de destruction de BPC exploitée par PPM (Canada) Inc. Environ 10 000 litres d'huile pour transformateur contenant approximativement 750 ppm de BPC ont été décontaminés.

Durant les deux jours de l'analyse, on a examiné un total de 283 échantillons atmosphériques de deux minutes en vue de détecter certains BPC à l'aide de l'analyseur des gaz atmosphériques à l'état de trace (modèle 3000). Aucune des 19 concentrations moyennes de BPC réparties sur une demi-heure (calculées à partir des échantillons prélevés sur une période de deux minutes) ne dépassait la limite recommandée par le Ministère, c'est-à-dire  $0,45 \text{ ug/m}^3$  sur une demi-heure. En fait, on n'a détecté de BPC pendant aucune des périodes de surveillance et dans aucun échantillon de fond. La limite de détection moyenne de l'analyseur était de  $0,11 \text{ ug/m}^3$  pour l'ensemble des BPC (depuis les dichlorobiphényles jusqu'aux pentachlorobiphényles).

## 1.0 Introduction

In response to a special request by the Halton-Peel District Office of the Central Region, the mobile Trace Atmospheric Gas Analyser (TAGA 3000) unit of the Air Resources Branch conducted an ambient air quality survey in Mississauga (Port Credit) on September 30 and October 1, 1987. The purpose of the survey was to provide, on-site, ambient air concentration measurements of selected PCBs in the vicinity of the mobile PCB destruction unit operated by PPM (Canada) Incorporated. PPM had been contracted by Texaco's Mississauga Refinery to decontaminate several transformers containing PCBs in concentration levels up to 83,000 ppm. After dilution, the final volume of oil requiring decontamination was roughly 10,000 litres with an initial PCB concentration of 750 ppm.

The process employed by PPM is based on the well-known reaction of metallic sodium with chlorinated biphenyls to produce biphenyls and sodium chloride. Contaminated oil is pumped into a reaction vessel (tank) where it is mixed with sodium and naphthalene. Once the PCB level is reduced to less than 2 ppm (which is well below the Ministry of Environment's PCB contamination Guideline of 50 ppm), the oil is transferred to a storage tank. Both the reaction vessel and the storage tank vent to the atmosphere by way of a short pipe. Emissions from these tanks first pass through an oil de-mister and a charcoal filter.

The mobile TAGA unit was present on September 30 and October 1, 1987 during the entire PCB decontamination process, from the initial transfer of contaminated oil into the reaction vessel, to the completion of the reaction, at which time the PCB level of the oil was less than 2 ppm. The monitoring results, which were obtained every 2 minutes, were conveyed by the TAGA scientists to the Ministry's Halton-Peel District Office, represented by Mr. Grant Irrow.

This report summarizes the findings of the Mississauga survey and presents the unique analytical protocol used by the TAGA unit to obtain near real-time measurement of gaseous PCBs.

## 2.0 TAGA Technology and Survey Strategy

A detailed description of the PCB monitoring technique is provided in Appendix A. Briefly, the TAGA (model 3000) is a specialized mass spectrometer (MS) with a unique ion source based on the principle of atmospheric pressure chemical ionization (APCI). The system design permits direct analysis of air samples in the near real-time for a broad range of airborne pollutants.

To monitor ambient PCBs, the APCI ion source is coupled to an Automated Short Term Adsorber (ASTA) which is a sample preconcentrator and thermal desorption unit. The TAGA/ASTA technique provides ambient PCB measurements continuously every 2 minutes. Half-hour averaged concentrations of PCBs are determined by simply computing the arithmetic mean of 15 2-minute averaged concentrations. For this particular survey, the air was screened for the di-, tri-, tetra-, and pentachlorobiphenyl isomer groups.

The survey strategy for this study was to position the mobile TAGA unit, as close as possible, downwind of the PPM mobile destruction unit and monitor the air for selected PCBs. The readings, which were obtained every 2 minutes, were then compared to previously determined background data. Background levels were ascertained downwind of PPM prior to the commencement of the destruction process. During the actual destruction process, monitoring by the TAGA proceeded for several hours, over two days, until the oil was decontaminated to less than 2 ppm. Since the monitoring results were known within minutes of the sampling periods, Ministry personnel evaluated the data on-site, and determined if PPM's activities caused an increase in ambient PCB levels.

The TAGA was calibrated for PCB detection before and during the PCB destruction process. Calibration and background data were used to calculate the detection limit (which is defined as 3 times the standard deviation of the background signal, recorded at the PCB target masses, divided by the sensitivity factors per unit  $\text{ug}/\text{m}^3$ ). The detection limits for total PCBs monitored (di- to pentachlorobiphenyl) were 0.08  $\text{ug}/\text{m}^3$  on September 30, and 0.14  $\text{ug}/\text{m}^3$  on October 1. The meteorological data collected during this survey are found in Appendix B.

## 3.0 Results and Discussion

### September 30

The mobile TAGA unit arrived at the Texaco Refinery in Mississauga (Port Credit) at 08:45 hours on September 30, 1987.

Calibrations were conducted to determine the sensitivity of the instrument. As seen in Table 1 (samples 1 and 2), two (2) 1/2-hour averages of background data were obtained directly downwind of the PPM destruction unit (See Map 1), prior to the transfer of transformer oil containing 83,000 ppm of PCBs to the reaction vessel. (Recall that a 1/2-hour averaged concentration consists of 15 2-minute air samples). The detection limit for total PCBs (di- to pentachlorobiphenyl) was calculated at 0.08 ug/m<sup>3</sup>.

A total of ten 1/2-hour averaged concentrations were determined downwind of the PCB destruction unit from the initial transfer of oil to the halting of the operation at 18:35 hours (See Table 1). PCBs were not present above the detection limit in any of these 1/2-hour averages.

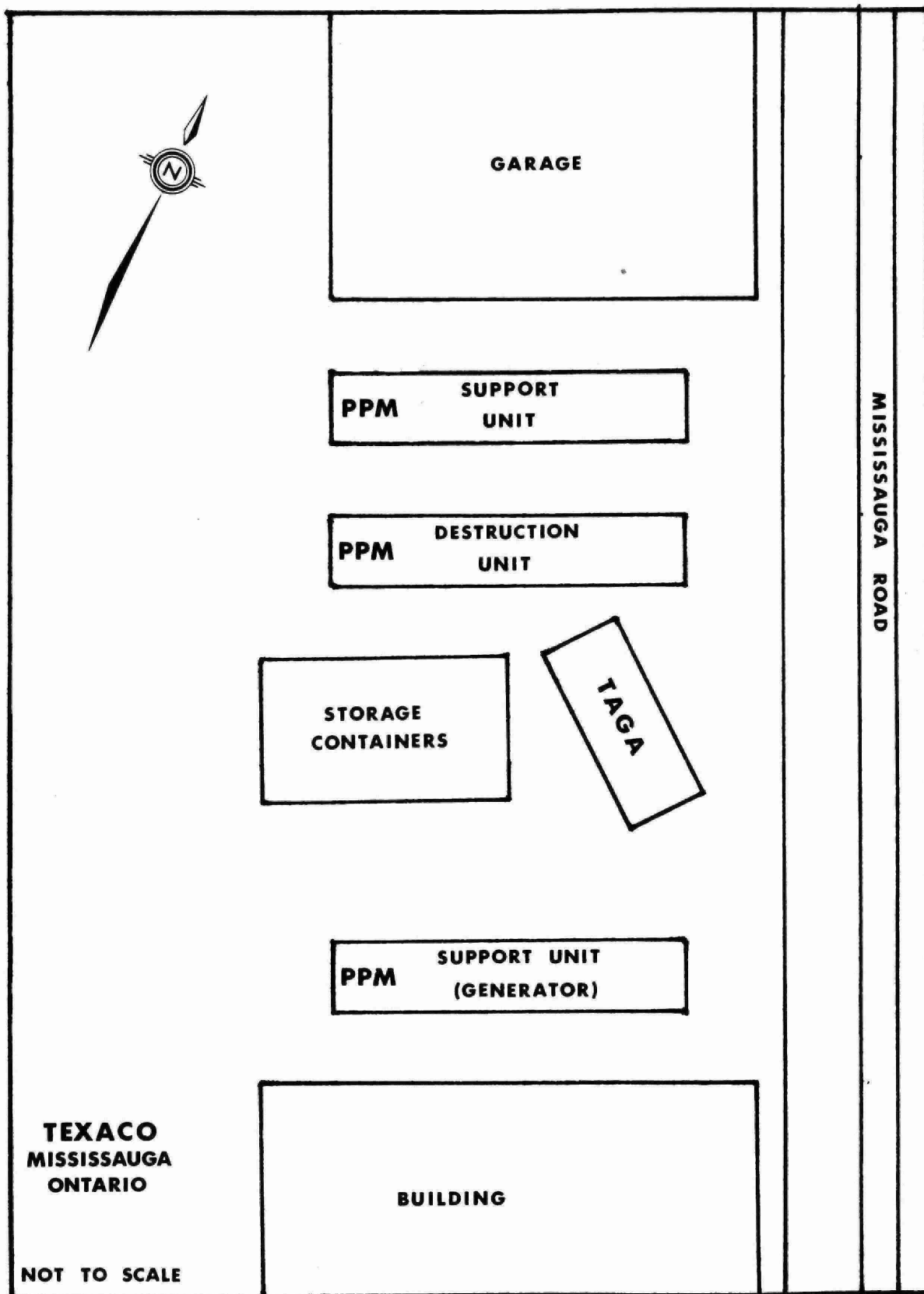
A second calibration was conducted at 13:20 hours. A final calibration and background data were obtained at 18:53 hours, after PPM ceased operation for the day, before the TAGA crew returned to Toronto.

#### October 1

The TAGA arrived back at the Texaco Refinery at 08:15 hours on October 1, 1987. A calibration was performed and background data was acquired prior to commencement of the PCB destruction (Table 2, sample 13). The detection limit for total PCBs was calculated at 0.14 ug/m<sup>3</sup>. All monitoring was conducted at the same location as the previous day.

A total of six 1/2-hour averages were recorded during the decontamination procedure (See Table 2). As observed the previous day, PCBs were not detected above the TAGA's daily analytical detection limit.

At 14:00 hours, PPM notified the TAGA crew that the PCB level in the oil was below 2 ppm and the decontamination was complete. Thus the air monitoring survey was halted and the TAGA crew returned to Toronto.



Map 1: Monitoring Site for Mobile TAGA Unit  
Mississauga Survey, September 1987

Table 1  
TAGA PCB Survey: PPM Canada Inc.  
Texaco, Mississauga, September 30, 1987

Sample	Start <sup>1</sup> Time	Meteorology <sup>2</sup>			1/2-Hour <sup>3</sup> Average	Comments
		WS	WD	AT		
1	10:21	5-15	NW	19	ND	downwind of PPM, prior to PCB destruction
2	10:53	5-20	NNW	17	ND	downwind of PPM, prior to PCB destruction
3	11:30	5-20	NNW	19	ND	downwind of PPM, pumping PCB/oil from transformer
4	12:12	10-25	N	20	ND	downwind of PPM, destruction on-going
5	12:44	5-25	NNW	21	ND	downwind of PPM, Na added to PCB/oil
6	13:58	10-25	NNW	20	ND	downwind of PPM, destruction on-going
7	14:30	10-20	NNW	20	ND	downwind of PPM, destruction on-going
8	15:08	10-30	NNW	16	ND	downwind of PPM, Na added to PCB/oil
9	15:40	10-25	NNW	13	ND	downwind of PPM, destruction on-going
10	17:06	5-20	NNW	14	ND	downwind of PPM, destruction on-going
11	17:38	5-15	NNW	13	ND	downwind of PPM, destruction on-going
12	18:13	5-15	N	13	ND	downwind of PPM, destruction stopped

- Notes:
1. Start time refers to the start of adsorption time of the first sample.
  2. WS = wind speed range (km/hr); WD = predominant wind direction;  
AT = ambient temperature (°C)
  3. 1/2-hour concentration of gaseous PCBs (di- to pentachlorobiphenyls);  
mean of 15 2-minute samples. ND = not detected.

Table 2  
TAGA PCB Survey: PPM Canada Inc.  
Texaco, Mississauga, October 1, 1987

Sample	Start <sup>1</sup> Time	Meteorology <sup>2</sup>			1/2-Hour <sup>3</sup> Average	Comments
		WS	WD	AT		
13	09:16	0-15	NNW	11	ND	downwind of PPM, background prior to destruction
14	10:07	5-15	NNW	14	ND	downwind of PPM, Na added to PCB/oil
15	10:39	5-15	NW	16	ND	downwind of PPM, destruction on-going
16	11:15	0-15	NNW	17	ND	downwind of PPM, destruction on-going
17	11:47	0-15	NNW	17	ND	downwind of PPM, destruction on-going
18	12:44	5-15	WNW	17	ND	downwind of PPM, destruction on-going
19	13:27	5-15	NW	18	ND	downwind of PPM, stopped monitoring, PCBs <2ppm

- Notes:
1. Start time refers to the start of adsorption time of the first sample.
  2. WS = wind speed range (km/hr); WD = predominant wind direction;  
AT = ambient temperature (°C)
  3. 1/2-hour concentration of gaseous PCBs (di- to pentachlorobiphenyls);  
mean of 15 2-minute samples. ND = not detected.



Appendix A ... TAGA Methodology for PCB Monitoring

## TAGA METHODOLOGY

In 1979 the Air Resources Branch of the Ontario Ministry of the Environment acquired a mobile Trace Atmospheric Gas Analyzer (TAGA 3000) manufactured by Sciex Incorporated of Thornhill, Ontario. The mobile TAGA unit (MAMU No. 3) has been applied to a variety of air monitoring situations, including airborne PCBs. The Ministry has conducted over 50 air quality surveys with the mobile TAGA unit.

The TAGA 3000 is a highly specialized quadrupole mass spectrometer coupled to a unique sampling inlet and ion source (See Figure A1). Ionization of pollutants is achieved through chemical ionization, initiated by a stable corona discharge operating at atmospheric pressure. Since the ion source permits continuous, direct, air sampling at a high flow rate (100 l/min), it is possible to determine the temporal and spatial distribution of selected pollutant levels. The mobile TAGA's capabilities are especially suitable for plume tracking; that is, tracing a pollutant back to its source of origin.

When equipped with the standard atmospheric-pressure chemical ionization (APCI) source the TAGA system is sensitive to most volatile compounds containing a heteroatom, such as N, O, S, P and halide. Typical detection limits are in the range of 0.1 to 10 ug/m<sup>3</sup> depending on the type of chemical measured and the sample matrix.

The mobile TAGA unit is also equipped with a 10 metre, telescopic tower and meteorological instrumentation to measure local wind speed, wind direction and ambient temperature. All meteorological data are stored by the on-board computer simultaneously with the collection of air quality data. The data are instantly displayed on the CRT unit allowing the operator to assess the data on-site and thus formulate the appropriate survey strategy.

## PCB MONITORING METHODOLOGY

For most chemical classes the sensitivity of the TAGA is extraordinary for ambient air monitoring. However PCBs are one of the exceptions, because the absolute sensitivity is insufficient for instantaneous real-time detection relative to the low guideline set by the Ministry for PCBs ( $0.45\mu\text{g}/\text{m}^3$ ). Thus in the late 1970's Sciex Inc. developed a simple sampling device to preconcentrate volatile PCBs. Preconcentrating the PCBs for only 2-minutes lowers the detection limit by two orders of magnitude.

Although the basic principles have remained unchanged, today's PCB preconcentrator has evolved into a portable sampling inlet system with all operating parameters under strict computer control. It is commercially known as the Automated Short Term Adsorber or ASTA.

The ASTA, shown in Figure A2, consists of two sample probes formed by coiling a nichrome wire, coated with a gas chromatographic stationary phase, OV-17. The positions, and thus functions of the two probes, are interchangeable between the adsorption or sampling position, and the desorption or analysis position. While one probe is adsorbing PCBs from the ambient air, the other probe is being desorbed and analysed for PCBs from a previous air sample. Altering the positions of the two probes permits continuous screening of the ambient air in 2 minute intervals. There is approximately an eight second delay between sampling periods due to the probe cycling time. Thus a "1/2-hour sample", which consists of 15 consecutive 2 minute samples, takes 32 minutes.

### Sampling

When sampling for PCBs the probe is placed directly in the ambient air stream ( $1.7\text{ l/s}$ ) for a period of 2 minutes. The probe is then changed to the desorb position and 12 volts DC potential (3.25 amperes) is applied to the probe for a period of 40 seconds. This causes the probe temperature to rapidly increase to approximately  $300^\circ\text{C}$ , thereby transferring the PCBs from the OV-17 into the gas phase. The carrier gas, which is a mixture of ultra pure zero air and benzene (100 ppm), constantly sweeps the PCBs into the ion source. Upon entering the ion source the PCBs immediately undergo benzene chemical ionization, producing molecular PCB ions ( $\text{M}^+$ ) which are (mass) selectively monitored by the quadrupole mass filter.

The software allows for the screening of 4 PCB isomer groups at 8 masses, 2 isotopes per isomer group. Normally the

dichlorobiphenyl to pentachlorobiphenyl species are monitored. There are several reasons for this: firstly, the TAGA is more sensitive to these species. Secondly, PCBs with lower molecular weights generally exhibit higher vapour pressures, thus increasing the likelihood of gas phase detection; and, thirdly, in previous PCB surveys the higher molecular weight PCBs were rarely detected when the lower molecular weight PCBs were not observed.

#### Calibration

Calibration of the system, including sampling probe adsorption efficiencies and TAGA response, is accomplished by continuously injecting known amounts of PCBs directly into the air sampling stream. The PCBs are injected via a heated injection port (300 °C) using a gas-tight syringe and motorized syringe drive. The PCB standards are prepared by the dissolution of pure PCB congeners, one per isomer group, into iso-octane. Repeated injections at 5 different syringe drive settings establishes a calibration curve which is linear (correlation coefficients are usually better than 0.995) over the PCB concentration range of 0.425 to 2.5 ug/m<sup>3</sup> per isomer group (See Figure A3). The relative standard deviations for multiple injections of PCB standards are typically better than 5% at the 0.425 ug/m<sup>3</sup> level.

## DATA PROCESSING AND INTERPRETATION

Immediately following a desorption of the probe, the TAGA computer calculates the level of PCBs (or equivalents) per isomer group, from the net signal (sample minus background) and the daily calibration factors. In fact, for each PCB isomer group, two measurements are made: one for the chlorine 35 isotope (M), and one for the corresponding chlorine 37 isotope (M+2).

### Criteria

At this stage the field survey scientist interprets the reduced data using the following criteria:

- 1) the adsorption peak (integrated signal) must be at least 3 times greater than the signal noise ( $S/N > 3$ );
- 2) the PCB levels for a given isotope pair must be within the overall experimental accuracy of 20%;
- 3) the calculated isotope ratios must be within 10% of the theoretical isotope ratio for a given isomer group.

If condition 1) above is not satisfied, the isomer group concentration will be considered below the detection limit and a ND is reported. If conditions 2) and 3) are not evident then a chemical interference at one, or both, of the isomer groups is assumed to be present, and the lower concentration value of the two isotopes is assigned the upper concentration limit for that particular PCB isomer group. The value is then flagged with the letter "i" indicating that a chemical interference has inflated the reported concentration. An example of a data print-out showing the PCB desorption curves may be seen in Figure A4.

### Detection Limit

The PCB detection limit for the TAGA/ASTA technique is defined as being 3 times the standard deviation of the background signal observed at the PCB masses, divided by the appropriate calibration factors. Thus by definition, the detection limit depends on two important factors:

- i) the sensitivity, which is a function of the probe adsorption efficiencies and the benzene chemical ionization rates.
- ii) the level of the interferences (adsorbed compounds that have the same nominal ionic mass as the targeted PCBs in both upwind and downwind air samples). Interference

levels are highly variable depending on the sampling site, the source(s) in the immediate area, and the local meteorological conditions.

During a survey air samples are spiked periodically with 0.425 ug/m<sup>3</sup> per PCB isomer group to establish the daily sensitivity factors and determine, on-site, the detection limits of the technique. Typical detection limits range from 0.01 to 0.05 ug/m<sup>3</sup> per isomer group, or from 0.04 to 0.20 ug/m<sup>3</sup> for total (di to pentachlorobiphenyls) PCBs, depending on the complexity of the sample matrix.

#### SUMMARY

The TAGA/ASTA PCB monitoring technique is a specialized application of the mobile TAGA 3000. It was developed to rapidly screen the ambient air for volatile PCBs. Important features of the technique to consider when assessing the data are:

- 1) The technique was developed to measure gas phase PCBs. (Should non-volatile PCBs be trapped by the probe they would be reported as volatile PCBs and included in the total amounts.)
- 2) PCB levels are determined continuously in 2 minute periods.
- 3) Four isomer groups are monitored simultaneously (normally the dichlorobiphenyls to pentachlorobiphenyls).
- 4) The detection limits for total PCBs typically range from 0.04 to 0.20 ug/m<sup>3</sup> depending on the sample matrix.

In summation, the mobile TAGA/ASTA technique is a rapid screening method for volatile PCBs, providing near real-time detection at the time when PCBs are potentially released into the atmosphere. It is the only method currently available to the Ministry by which the ambient air can be instantaneously scanned for PCBs, providing valuable information, on-site.

## TAGA 3000 SYSTEM

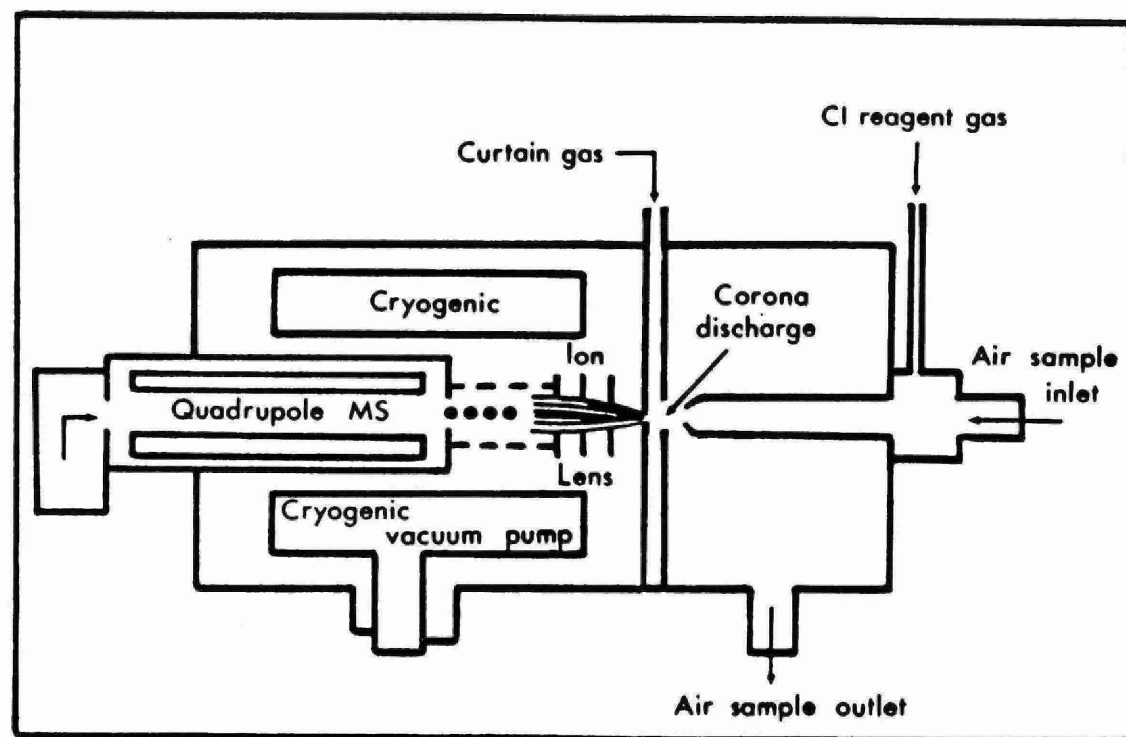


FIGURE A1: SCHEMATIC OF THE TAGA 3000 SYSTEM  
INSTALLED IN MAMU #3

# ASTA SCHEMATIC

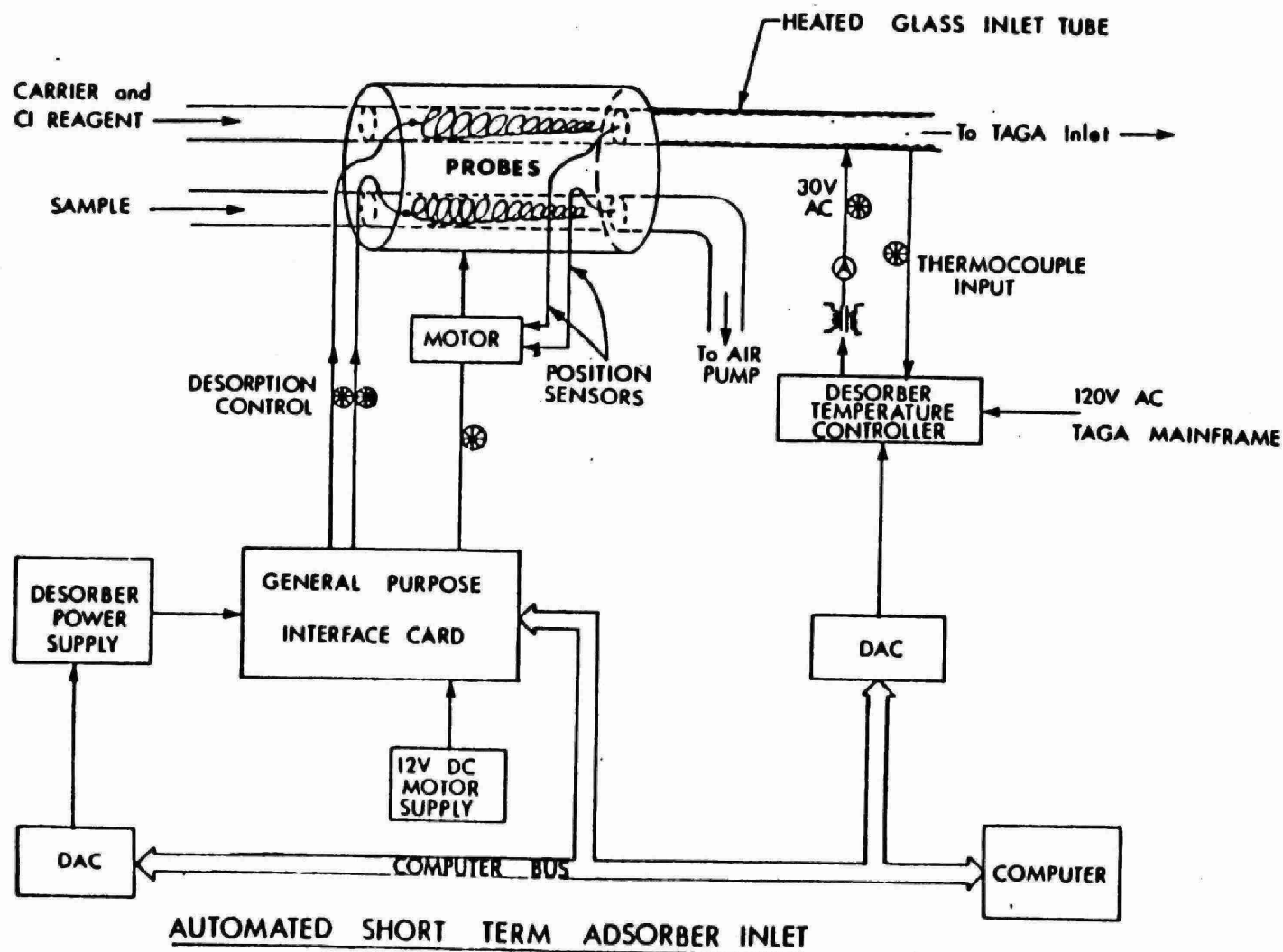


Figure A2: Schematic of the ASTA used in conjunction with the TAGA

Monitoring technique.



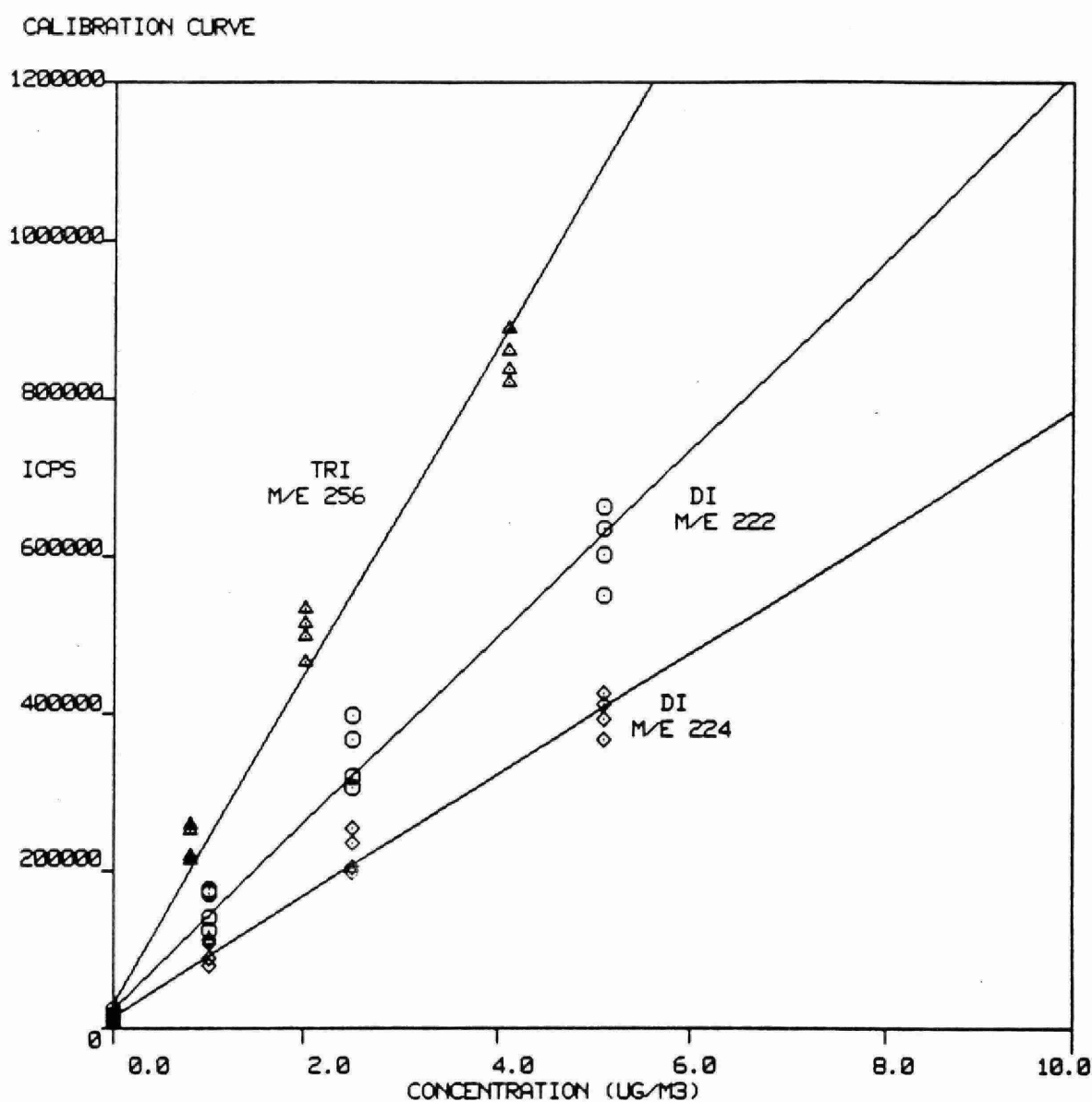
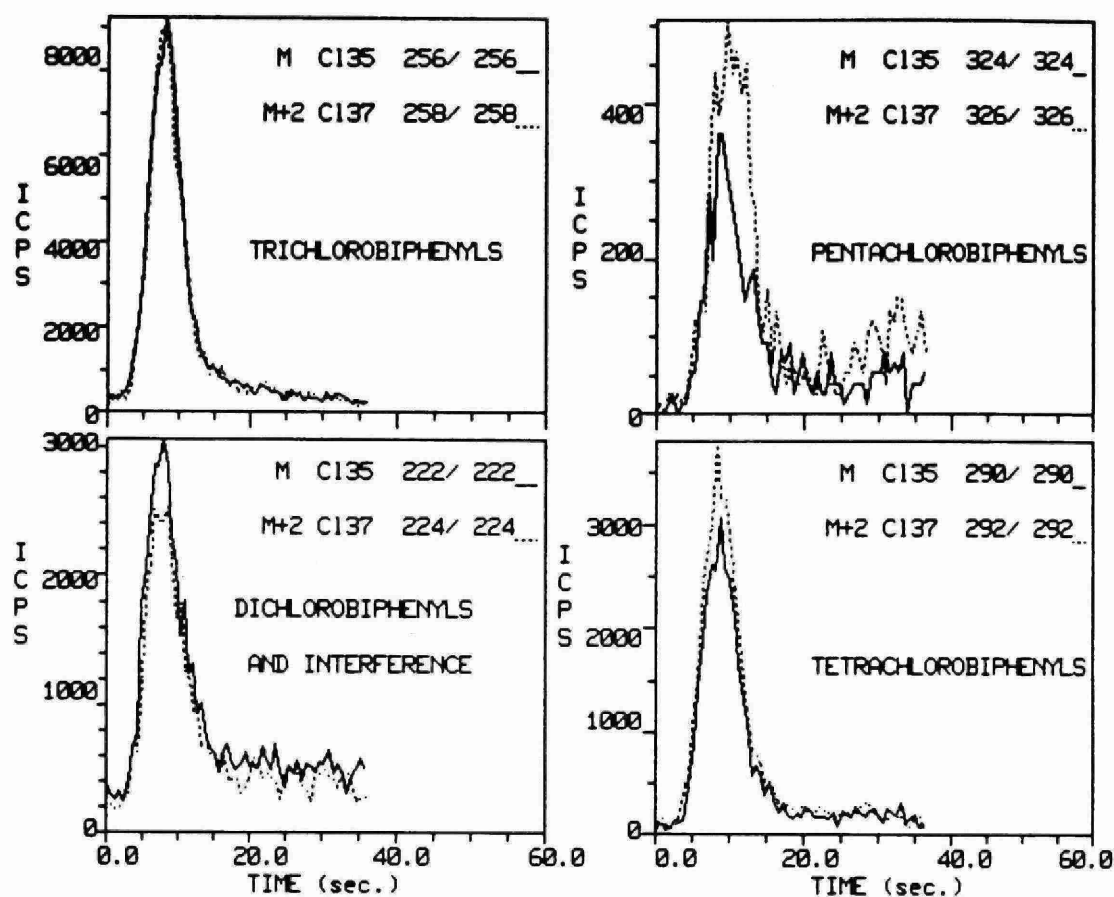


FIGURE A3: EXAMPLE OF CALIBRATION CURVE  
FOR DI AND TRICHLOROBIPHENYLS  
TAGA/ASTA MONITORING TECHNIQUE



MP/MD	MAX.INT	TIM.MAX	INT.IONS	NET	CONC	RATIO TO MP/MD		THEOR.
222/ 222	3053.	8.40	17143.	14691.	0.39i	1.283	224/ 224	1.540
224/ 224	2520.	9.12	13994.	11452.	0.47i	0.780	222/ 222	0.650
256/ 256	9213.	8.56	46335.	43368.	0.60	1.056	258/ 258	1.030
258/ 258	8906.	8.64	43545.	41069.	0.62	0.947	256/ 256	0.975
290/ 290	3067.	9.36	14284.	12730.	0.23	0.818	292/ 292	0.769
292/ 292	3800.	8.80	17271.	15562.	0.23	1.222	290/ 290	1.300
324/ 324	360.	9.52	1707.	1303.	0.10	0.620	326/ 326	0.615
326/ 326	507.	10.24	2662.	2099.	0.11	1.612	324/ 324	1.626

1.3

FIGURE A4: Example of TAGA data print-out, PCB analysis. Concentrations are in units of ug/m3. Note the ratio for isotope 222/224 dichlorobiphenyl is mismatched, where "i" denotes a contribution by interference at masses 222 and/or 224. The total PCB level is computed to be 1.3 ug/m3.

Appendix B ... Meteorological Data: TAGA Station

MISSISSAUGA: TEXACO

Start: 87/09/30 09:11:00 File: MI3001.MET  
 Scan: 30 sec Ave: 5.00 min Rep: 5.00 min Rnd: 5.0 min  
 Loc: S OF GARAGE  
 Met: PARTLY CLOUDY

-- Time --	Temp d C	W-Spd km/hr	W-Dir deg
09:15:00 - 09:20:00	14.6	12.6	274.
09:20:00 - 09:25:00	14.8	11.0	271.
09:25:00 - 09:30:00	15.6	10.1	281.
09:30:00 - 09:35:00	15.4	11.5	279.
09:35:00 - 09:40:00	15.1	14.5	279.
09:40:00 - 09:45:00	15.3	11.9	295.
09:45:00 - 09:50:00	15.7	14.0	296.
09:50:00 - 09:55:00	15.9	18.8	301.
09:55:00 - 10:00:00	16.1	13.8	293.
10:00:00 - 10:05:00	16.2	13.0	307.
10:05:00 - 10:10:00	16.6	16.8	303.
10:10:00 - 10:15:00	17.9	9.1	318.
10:15:00 - 10:20:00	18.7	10.8	319.
10:20:00 - 10:25:00	19.3	8.7	317.
10:25:00 - 10:30:00	19.5	13.7	294.
10:30:00 - 10:35:00	19.3	10.7	318.
10:35:00 - 10:40:00	19.6	9.6	317.
10:40:00 - 10:45:00	19.1	12.3	318.
10:45:00 - 10:50:00	18.0	12.5	335.
10:50:00 - 10:55:00	17.5	11.6	324.
10:55:00 - 11:00:00	17.1	11.6	5.
11:00:00 - 11:05:00	16.9	9.4	345.

Continue: [Y/N] > \_

11:05:00 - 11:10:00	16.8	9.7	348.
11:10:00 - 11:15:00	16.7	14.0	354.
11:15:00 - 11:20:00	17.3	9.2	342.
11:20:00 - 11:25:00	17.6	8.9	338.
11:25:00 - 11:30:00	18.3	10.5	350.
11:30:00 - 11:35:00	17.8	8.5	354.
11:35:00 - 11:40:00	19.7	6.3	340.
11:40:00 - 11:45:00	20.0	21.1	321.
11:45:00 - 11:50:00	19.7	19.0	325.
11:50:00 - 11:55:00	19.6	14.4	327.
11:55:00 - 12:00:00	19.7	13.6	349.

Continue: [Y/N] > Y  
 MISSISSAUGA: TEXACO

- File: MI3001.MET

Page: 3

	Temp d C	W-Spd km/hr	W-Dir deg
Arith. Mean	17.5	-	-
Std. Dev.	1.7	-	-
Min. Reading	14.5	1.9	0.
Max. Reading	20.8	29.1	359.
Min. Average	14.6	6.3	5.
Max. Average	20.0	21.1	354.
* Valid Rdgs	337.	337.	337.

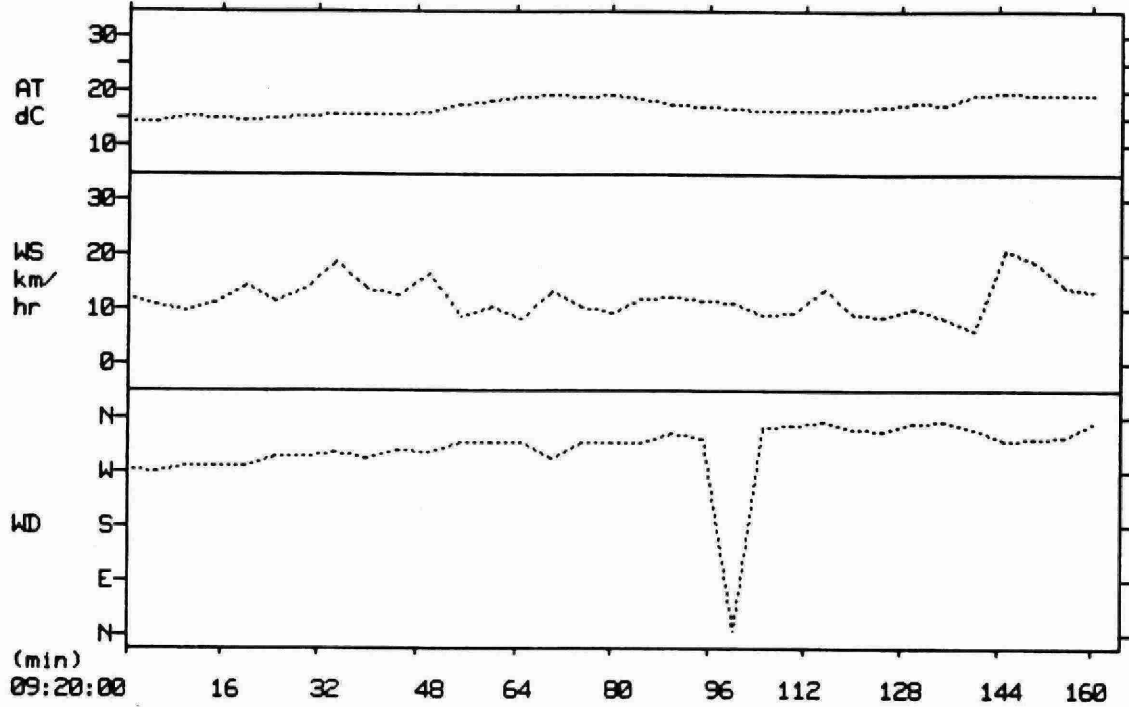
- Invalid Data / Not Calculated  
 m One or more readings Missing

Percent Valid Data Required for Valid Average: 75.0 %  
 Averaging Started at Nearest: 5.0 min

Do you want graphical output? [Y/N] \_

MISSISSAUGA: TEXACO

Start: 87/09/30 09:11:00 File: MI3001.MET  
 Scan : 30 sec Ave: 5.00 min Rep: 5.00 min Rnd: 5.0 min  
 Loc : S OF GARAGE  
 Met : PARTLY CLOUDY



MISSISSAUGA: TEXACO

Start: 87/09/30 12:10:00 File: MI3002.MET  
 Scan : 30 sec Ave: 5.00 min Rep: 5.00 min Rnd: 5.0 min  
 Loc : DOWNWIND OF PPM VENT  
 Met : PARTLY CLOUDY

— Time —	Temp d C	W-Spd km/hr	W-Dir deg
12:10:00 - 12:15:00	20.8	12.6	3.
12:15:00 - 12:20:00	20.4	16.1	360.
12:20:00 - 12:25:00	20.8	14.6	6.
12:25:00 - 12:30:00	21.1	13.6	13.
12:30:00 - 12:35:00	19.8	17.9	18.
12:35:00 - 12:40:00	20.7	13.2	2.
12:40:00 - 12:45:00	20.7	14.6	350.
12:45:00 - 12:50:00	20.9	14.6	357.
12:50:00 - 12:55:00	20.8	16.1	354.
12:55:00 - 13:00:00	20.0	16.7	351.
13:00:00 - 13:05:00	21.1	18.9	331.
13:05:00 - 13:10:00	22.3	12.4	320.
13:10:00 - 13:15:00	23.5	14.9	342.
13:15:00 - 13:20:00	23.0	14.1	340.
13:20:00 - 13:25:00	22.3	12.5	11.
13:25:00 - 13:30:00	21.9	15.7	348.
13:30:00 - 13:35:00	21.2	15.4	345.
13:35:00 - 13:40:00	20.0	16.3	351.

Continue: [Y/N] >

	Temp d C	W-Spd km/hr	W-Dir deg
Arith. Mean	21.2	-	-
Std. Dev.	1.1	-	-
Min. Reading	19.4	3.1	1.
Max. Reading	24.2	28.2	360.
Min. Average	19.8	12.4	2.
Max. Average	23.5	18.9	360.
‡ Valid Rdgs	189.	189.	189.

- Invalid Data / Not Calculated

m One or more readings Missing

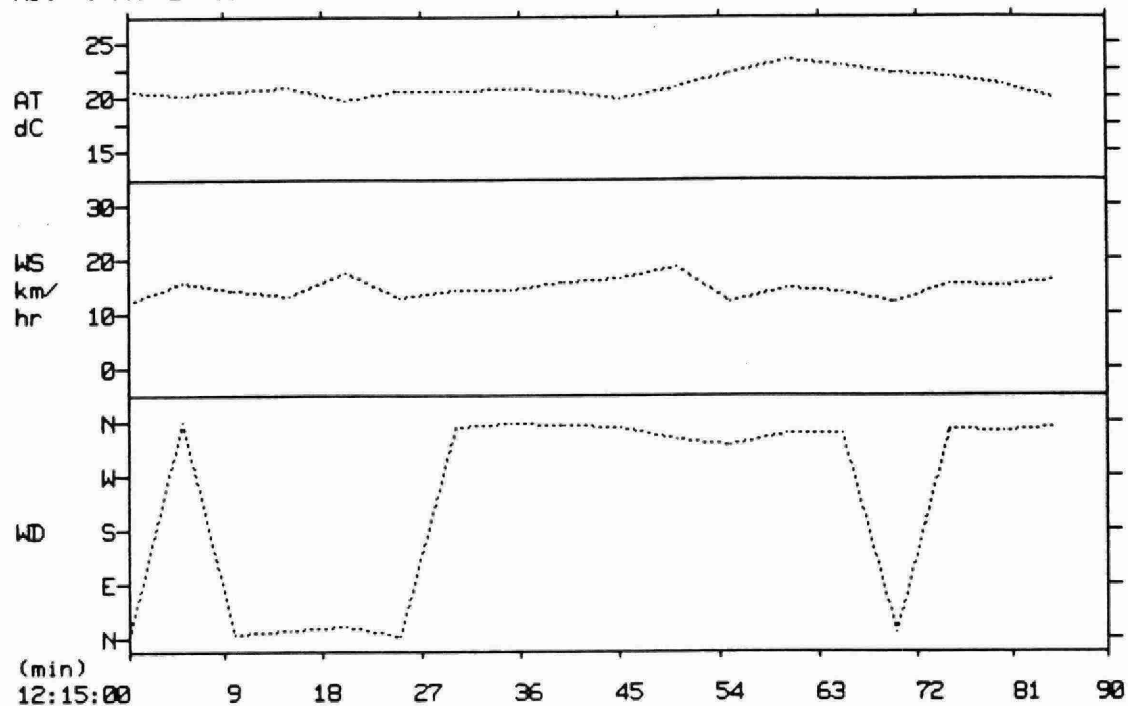
Percent Valid Data Required for Valid Average: 75.0 %  
Averaging Started at Nearest: 5.0 min

Do you want graphical output? [Y/N]



# MISSISSAUGA: TEXACO

Start: 87/09/30 12:10:00 File: MI3002.MET  
 Scan : 30 sec Ave: 5.00 min Rep: 5.00 min Rnd: 5.0 min  
 Loc : DOWNWIND OF PPM VENT  
 Met : PARTLY CLOUDY



MISSISSAUGA:TEXACO

Start: 87/09/30 13:52:00 File: MI3003.MET  
 Scan : 30 sec Ave: 5.00 min Rep: 5.00 min Rnd: 5.0 min  
 Loc : DW OF PPM DESTRUCTION UNIT  
 Met : SUNNY AND CLEAR

-- Time --	Temp d C	W-Spd km/hr	W-Dir deg
13:55:00 - 14:00:00	20.9	15.8	10.
14:00:00 - 14:05:00	20.5	16.8	0.
14:05:00 - 14:10:00	19.6	15.7	338.
14:10:00 - 14:15:00	19.4	14.1	314.
14:15:00 - 14:20:00	19.5	12.9	347.
14:20:00 - 14:25:00	19.4	9.0	334.
14:25:00 - 14:30:00	19.3	8.3	5.
14:30:00 - 14:35:00	20.2	12.2	324.
14:35:00 - 14:40:00	20.6	10.7	359.
14:40:00 - 14:45:00	20.6	12.2	331.
14:45:00 - 14:50:00	21.0	17.9	306.
14:50:00 - 14:55:00	19.9	18.9	318.
14:55:00 - 15:00:00	18.8	15.4	324.
15:00:00 - 15:05:00	18.0	19.2	341.
15:05:00 - 15:10:00	16.8	18.2	354.
15:10:00 - 15:15:00	16.3	16.1	343.
15:15:00 - 15:20:00	16.2	19.3	333.
15:20:00 - 15:25:00	15.8	22.8	321.
15:25:00 - 15:30:00	15.5	22.2	335.
15:30:00 - 15:35:00	15.0	21.8	337.
15:35:00 - 15:40:00	14.7	16.4	344.
15:40:00 - 15:45:00	14.3	19.8	342.

Continue: [Y/N] > \_

15:40:00 - 15:45:00 14.3 19.8 342.  
 Continue: [Y/N] > Y  
 MISSISSAUGA:TEXACO - File: MI3003.MET

Page: 2

-- Time --	Temp d C	W-Spd km/hr	W-Dir deg
15:45:00 - 15:50:00	14.0	17.2	335.
15:50:00 - 15:55:00	13.8	14.5	343.
15:55:00 - 16:00:00	12.9	11.9	1.
16:00:00 - 16:05:00	12.3	12.7	351.

Continue: [Y/N] > Y  
 MISSISSAUGA:TEXACO - File: MI3003.MET

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	Temp d C	W-Spd km/hr	W-Dir deg
Arith. Mean	17.3	-	-
Std. Dev.	2.9	-	-
Min. Reading	12.0	2.2	0.
Max. Reading	21.4	42.2	360.
Min. Average	12.3	8.3	0.
Max. Average	21.0	22.8	359.
* Valid Rdgs	269.	269.	269.

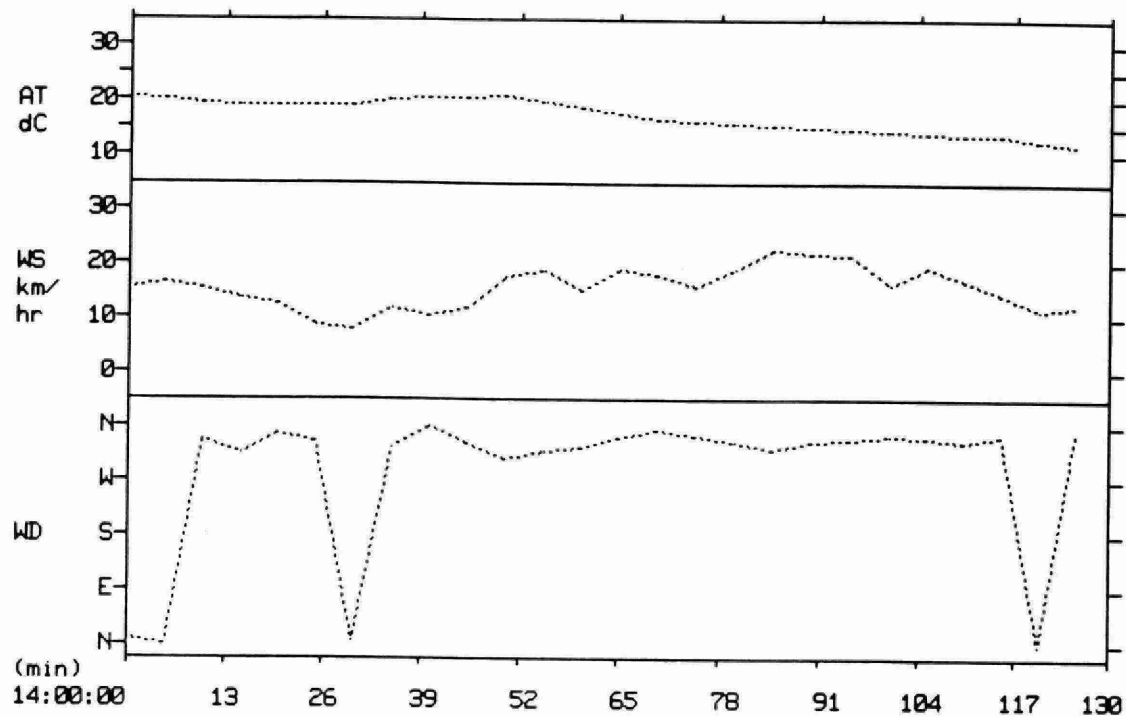
- Invalid Data / Not Calculated
- m One or more readings Missing

Percent Valid Data Required for Valid Average: 75.0 %  
 Averaging Started at Nearest: 5.0 min

Do you want graphical output? [Y/N] \_

# MISSISSAUGA: TEXACO

Start: 87/09/30 13:52:00 File: MI3003.MET  
 Scan : 30 sec Ave: 5.00 min Rep: 5.00 min Rnd: 5.0 min  
 Loc : DW OF PPM DESTRUCTION UNIT  
 Met : SUNNY AND CLEAR



MISSISSAUGA/TEXACO

Start: 87/09/30 17:02:00 File: MI3005.MET  
 Scan : 30 sec Ave: 5.00 min Rep: 5.00 min Rnd: 5.0 min  
 Loc : DW OF PCB DESTRUCTION SITE  
 Met : OVERCAST

-- Time --	Temp d C	W-Spd km/hr	W-Dir deg
17:05:00 - 17:10:00	16.0	6.9	333.
17:10:00 - 17:15:00	16.0	8.6	327.
17:15:00 - 17:20:00	15.1	12.2	355.
17:20:00 - 17:25:00	14.1	11.7	348.
17:25:00 - 17:30:00	13.8	11.0	353.
17:30:00 - 17:35:00	13.6	11.5	342.
17:35:00 - 17:40:00	13.8	13.1	338.
17:40:00 - 17:45:00	13.6	15.5	332.
17:45:00 - 17:50:00	13.5	14.7	349.
17:50:00 - 17:55:00	13.3	12.8	329.
17:55:00 - 18:00:00	13.3	9.3	336.
18:00:00 - 18:05:00	13.2	5.9	345.
18:05:00 - 18:10:00	13.0	7.9	335.
18:10:00 - 18:15:00	13.0	11.1	337.
18:15:00 - 18:20:00	12.9	6.7	341.
18:20:00 - 18:25:00	13.0	9.1	332.
18:25:00 - 18:30:00	12.9	9.9	344.
18:30:00 - 18:35:00	12.8	10.2	339.
18:35:00 - 18:40:00	12.8	10.6	348.
18:40:00 - 18:45:00	12.7	9.7	7.
18:45:00 - 18:50:00	12.6	12.8	5.
18:50:00 - 18:55:00	12.6	12.2	11.

Continue: [Y/N] > \_

-- Time --	Temp d C	W-Spd km/hr	W-Dir deg
18:55:00 - 19:00:00	12.4	10.9	2.
19:00:00 - 19:05:00	12.4	9.4	356.
19:05:00 - 19:10:00	12.2	19.1	6.
19:10:00 - 19:15:00	11.9	20.0	1.
19:15:00 - 19:20:00	11.7	19.8	356.
19:20:00 - 19:25:00	11.6	18.4	5.
19:25:00 - 19:30:00	11.5	12.3	1.
19:30:00 - 19:35:00	11.5	16.7	10.

Continue: [Y/N] > Y  
MISSISSAUGA/TEXACO

- File: MI3005.MET

Page: 3

	Temp d C	W-Spd km/hr	W-Dir deg
Arith. Mean	13.0	-	-
Std. Dev.	1.1	-	-
Min. Reading	11.2	1.7	1.
Max. Reading	16.2	30.9	359.
Min. Average	11.5	5.9	1.
Max. Average	16.0	20.0	356.
* Valid Rdgs	309.	309.	309.

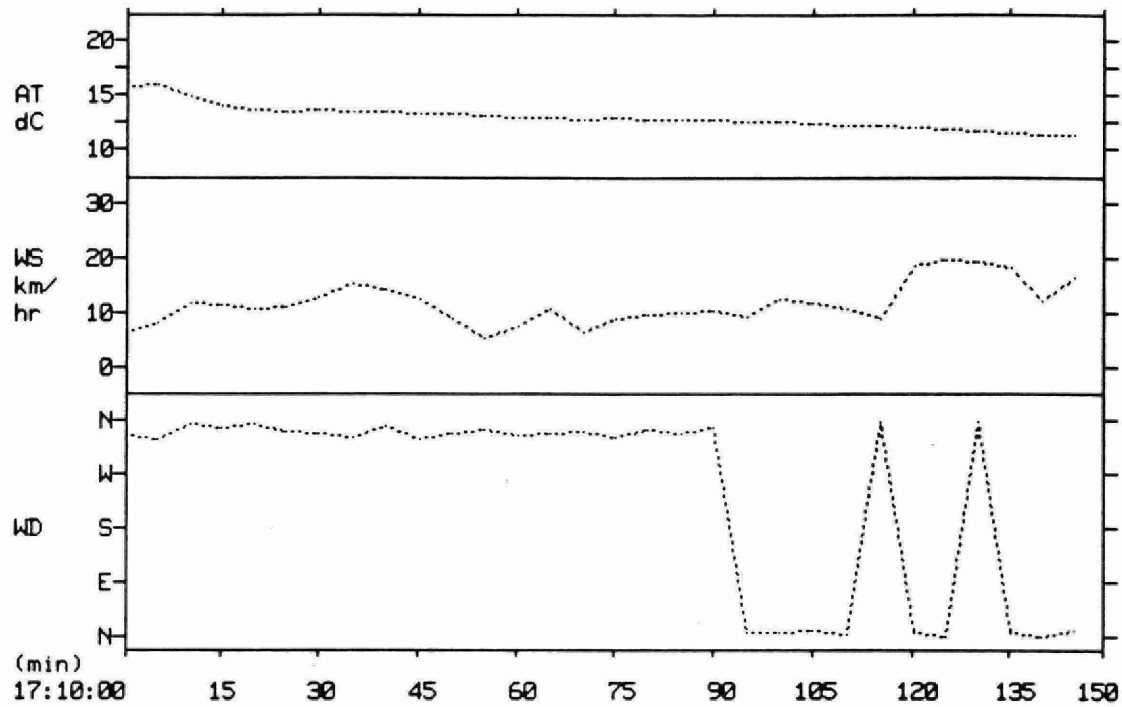
- Invalid Data / Not Calculated  
m One or more readings Missing

Percent Valid Data Required for Valid Average: 75.0 %  
Averaging Started at Nearest: 5.0 min

Do you want graphical output? [Y/N] \_

# MISSISSAUGA/TEXACO

Start: 87/09/30 17:02:00 File: MI3005.MET  
 Scan : 30 sec Ave: 5.00 min Rep: 5.00 min Rnd: 5.0 min  
 Loc : DW OF PCB DESTRUCTION SITE  
 Met : OVERCAST



MISSISSAUGA: TEXACO

Start: 87/10/01 08:25:00 File: MI0101.MET  
 Scan : 30 sec Ave: 5.00 min Rep: 5.00 min Rnd: 5.0 min  
 Loc : SOUTH OF PPM TRAILER (SITE #2)  
 Met : SUNNY & CLEAR

-- Time --	Temp d C	W-Spd km/hr	W-Dir deg
08:25:00 - 08:30:00	9.0	5.0	358.
08:30:00 - 08:35:00	9.1	8.5	3.
08:35:00 - 08:40:00	9.2	4.3	347.
08:40:00 - 08:45:00	9.5	6.8	355.
08:45:00 - 08:50:00	10.0	4.3	353.
08:50:00 - 08:55:00	9.9	8.8	2.
08:55:00 - 09:00:00	9.7	8.5	359.
09:00:00 - 09:05:00	9.7	11.5	5.
09:05:00 - 09:10:00	9.6	13.3	2.
09:10:00 - 09:15:00	10.1	6.3	345.
09:15:00 - 09:20:00	11.1	7.0	341.
09:20:00 - 09:25:00	11.1	4.5	357.
09:25:00 - 09:30:00	11.5	7.1	12.
09:30:00 - 09:35:00	12.1	10.6	332.
09:35:00 - 09:40:00	12.3	10.0	337.
09:40:00 - 09:45:00	11.7	9.3	4.
09:45:00 - 09:50:00	12.8	4.2	332.
09:50:00 - 09:55:00	13.6	8.2	338.
09:55:00 - 10:00:00	13.6	8.2	329.
10:00:00 - 10:05:00	13.9	7.9	325.
10:05:00 - 10:10:00	13.3	5.5	14.
10:10:00 - 10:15:00	14.0	14.3	326.

Continue: [Y/N] > \_



MISSISSAUGA: TEXACO

- File: MI0101.MET

Page: 2

-- Time --	Temp d C	W-Spd km/hr	W-Dir deg
10:15:00 - 10:20:00	14.1	10.6	326.
10:20:00 - 10:25:00	14.3	7.6	325.
10:25:00 - 10:30:00	14.1	3.9	324.
10:30:00 - 10:35:00	15.2	6.6	350.
10:35:00 - 10:40:00	15.5	5.0	355.
10:40:00 - 10:45:00	16.2	8.1	337.
10:45:00 - 10:50:00	15.5	9.6	6.
10:50:00 - 10:55:00	15.6	5.2	345.
10:55:00 - 11:00:00	15.4	12.5	289.
11:00:00 - 11:05:00	16.3	9.9	331.
11:05:00 - 11:10:00	17.7	8.2	347.
11:10:00 - 11:15:00	18.1	9.6	339.
11:15:00 - 11:20:00	19.3	7.3	322.
11:20:00 - 11:25:00	17.9	14.4	354.
11:25:00 - 11:30:00	13.5	7.5	21.
11:30:00 - 11:35:00	14.0	3.6	322.
11:35:00 - 11:40:00	16.0	10.6	330.
11:40:00 - 11:45:00	14.6	10.0	324.
11:45:00 - 11:50:00	15.1	4.9	303.
11:50:00 - 11:55:00	15.8	10.0	313.
11:55:00 - 12:00:00	15.6	10.3	315.
12:00:00 - 12:05:00	18.5	4.4	335.
12:05:00 - 12:10:00	18.8	5.1	340.
12:10:00 - 12:15:00	16.4	11.2	291.
12:15:00 - 12:20:00	17.1	8.9	293.
12:20:00 - 12:25:00	17.2	14.0	345.
12:25:00 - 12:30:00	16.3	9.1	337.
12:30:00 - 12:35:00	16.4	6.8	321.

Continue: [Y/N] > \_

MISSISSAUGA: TEXACO

- File: MI0101.MET

Page: 3

-- Time --	Temp d C	W-Spd km/hr	W-Dir deg
12:35:00 - 12:40:00	17.1	5.4	288.
12:40:00 - 12:45:00	17.6	11.2	293.
12:45:00 - 12:50:00	17.7	12.7	274.
12:50:00 - 12:55:00	16.1	10.0	295.
12:55:00 - 13:00:00	17.5	13.7	288.
13:00:00 - 13:05:00	18.6	6.0	303.
13:05:00 - 13:10:00	16.7	7.7	252.
13:10:00 - 13:15:00	16.0	14.9	280.
13:15:00 - 13:20:00	15.6	14.7	283.
13:20:00 - 13:25:00	16.0	17.0	276.
13:25:00 - 13:30:00	15.8	15.0	278.
13:30:00 - 13:35:00	17.5	12.2	296.
13:35:00 - 13:40:00	17.8	11.5	286.
13:40:00 - 13:45:00	18.7	11.4	316.
13:45:00 - 13:50:00	19.1	11.8	301.
13:50:00 - 13:55:00	17.3	11.4	332.
13:55:00 - 14:00:00	15.5	10.7	323.

Continue: [Y/N] > Y

MISSISSAUGA: TEXACO

- File: MI0101.MET

Page: 4

	Temp d C	W-Spd km/hr	W-Dir deg
Arith. Mean	14.8	-	-
Std. Dev.	2.9	-	-
Min. Reading	8.8	0.2	0.
Max. Reading	20.0	23.4	360.
Min. Average	9.0	3.6	2.
Max. Average	19.3	17.0	359.

	Temp d C	W-Spd km/hr	W-Dir deg
Arith. Mean	14.8	-	-
Std. Dev.	2.9	-	-
Min. Reading	8.8	0.2	0.
Max. Reading	20.0	23.4	360.
Min. Average	9.0	3.6	2.
Max. Average	19.3	17.0	359.
* Valid Rdgs	679.	679.	679.

- Invalid Data / Not Calculated

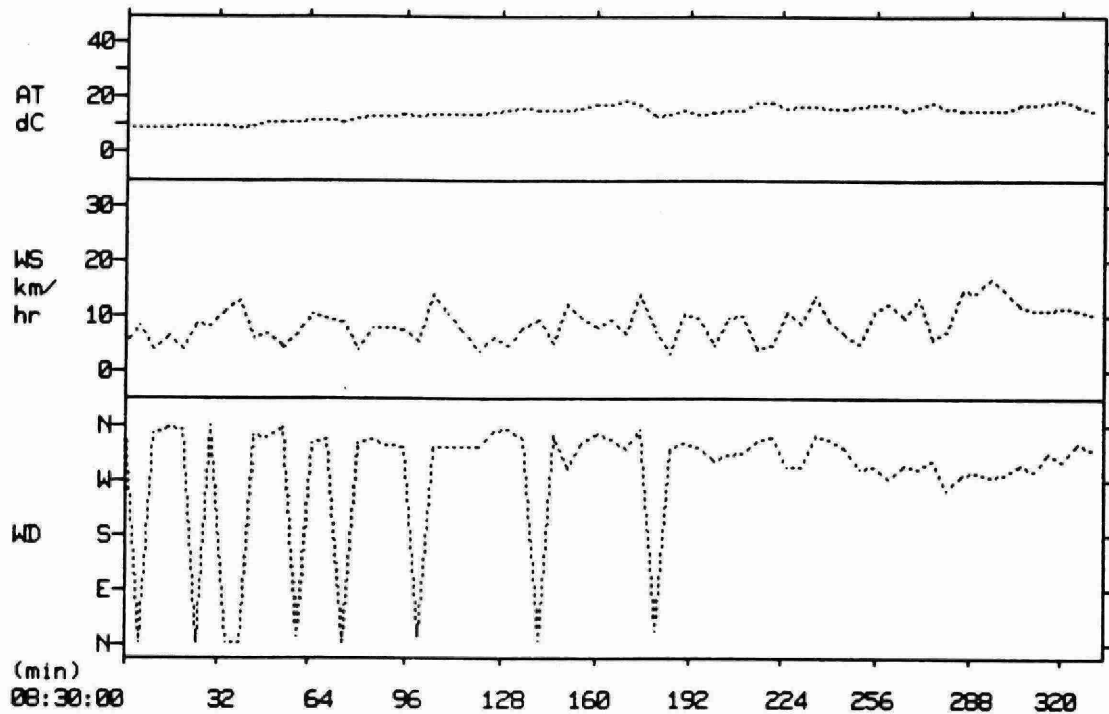
m One or more readings Missing

Percent Valid Data Required for Valid Average: 75.0 %  
Averaging Started at Nearest: 5.0 min

Do you want graphical output? [Y/N]

MISSISSAUGA: TEXACO

Start: 87/10/01 08:25:00 File: MI0101.MET  
 Scan : 30 sec Ave: 5.00 min Rep: 5.00 min Rnd: 5.0 min  
 Loc : SOUTH OF PPM TRAILER (SITE #2)  
 Met : SUNNY & CLEAR





\*96936000009462\*